

## Description

# IDENTIFIABLE INKJET CARTRIDGE AND METHOD OF PREVENTING MISPLACING INKJET CARTRIDGE IN AN INKJET APPARATUS

### CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. application Ser. No. 10/253,545 filed Sep. 25, 2002, U.S. application Ser. No. 10/253,544 filed Sep. 25, 2002, U.S. application Ser. No. 10/253,543 filed Sep. 25, 2002, and U.S. application Ser. No. 10/064,631 filed Aug. 01, 2002. All of the above-mentioned applications are included in their entirety herein by reference.

### BACKGROUND OF INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an inkjet apparatus, and more particularly to inkjet cartridges with an identifiable area and a method of preventing misplacing the inkjet

cartridges in the inkjet apparatus.

[0004] 2. Description of the Prior Art

[0005] The inkjet apparatus, such as a copy machine, facsimile machine, or inkjet printer, has become a necessity in modern life. The inkjet printer mainly includes a housing and a printing module situated inside the housing to perform the printing steps. The details of the printing module are described as follows.

[0006] Please refer to Fig.1 and Fig.2. Fig.1 is a perspective view of an inkjet apparatus 10 having printhead cartridges 114a and 114b installed. Fig.2 is a schematic drawing of a conventional printing module 100 in the inkjet apparatus 10. The printing module 100 includes a carriage 102, a rod 104, a print platform 106 and sidewalls 108a and 108b. The sidewalls 108a and 108b are set oppositely, and two ends of the rod 104 are respectively connected to the sidewalls 108a and 108b. The carriage 102, removably arranged on the rod 104, can move forward or backward over the print platform 106 along the direction of arrow 105, to accomplish the printing operation. The carriage 102 comprises the printed circuit boards (PCBs) 110a and 110b, and cartridge-setting slots 112a and 112b for placing the inkjet cartridges 114a and 114b therein. Also,

there are flexible PCBs 116a and 116b attached at surfaces 115a and 115b of the inkjet cartridges 114a and 114b, respectively. When the inkjet cartridges 114a and 114b are respectively put into the cartridge-setting slots 112a and 112b, the flexible PCBs 116a and 116b electrically couple to the PCBs 110a and 110b at the carriage 102. Therefore, current conducted into the flexible PCBs 116a and 116b through the PCBs 110a and 110b and the inkjet apparatus 10 controls the movement of the carriage 102 and drives the inkjet cartridges 114a and 114b to eject ink.

[0007] Generally, two inkjet cartridges are adapted in a printing module 100. One is a single-color cartridge 114b, usually filled with black ink. The other is a color cartridge 114a, having separated ink reservoirs and filled with different color inks such as cyan, magenta, and yellow ink. In the commercial inkjet printer market, there are other colors of ink to be used, such as light black, light cyan, light magenta, and light yellow. In addition, a photo cartridge can also be used in combination with a color cartridge for printing high quality photographs.

[0008] However, the similar external appearances of the conventional homochromatic cartridge and the color cartridge

confuse the user all the time. Consequently, the misplacement of cartridges in the carriage 102 occurs, which negatively affects the printing result. In order to put the homochromatic cartridge 114b and the color cartridge 114a into the correct positions in the carriage 102, which means that the flexible PCBs 116a and 116b are respectively electrically coupled to the PCBs 110a and 110b, some manufacturers try to create a difference in the cartridges 114a and 114b. For example, a different size can be used for each of the cartridges 114a and 114b. As shown in Fig.2, the size of the cartridge 114a is larger than that of the cartridge 114b; correspondingly, the space of cartridge setting slot 112a is larger than that of the cartridge setting slot 112b. The inkjet cartridge can only be installed in the size-matched cartridge setting slot. Accordingly, the misplacement of cartridges can be prevented.

[0009] Also, some manufacturers make an improvement in the configuration of the cartridge, so that the user can visually distinguish the cartridge model and its matched cartridge setting slot. However, the cartridges are usually mass-produced. Changing the configuration of the cartridge will raise the production cost.

## SUMMARY OF INVENTION

[0010] It is therefore an object of the claimed invention to provide an identifiable tape automated bonding (TAB) device disposed on an inkjet cartridge and a method of preventing misplacing inkjet cartridges in an inkjet apparatus in order to solve the above-mentioned problems.

[0011] According to the claimed invention, an identifiable TAB is disposed on an inkjet cartridge. The identifiable tab contains a flexible substrate, a plurality of conductive traces formed on the flexible substrate, and a plurality of contacts formed on the flexible substrate and connected to the conductive traces. The contacts of the identifiable TAB are arranged into at least one identifiable area for aiding in identifying the inkjet cartridge.

[0012] According to the claimed invention, a method of preventing misplacing inkjet cartridge that is adapted for an inkjet apparatus is disclosed. The inkjet apparatus includes a carriage equipped with a first inkjet cartridge and a second inkjet cartridge. The first inkjet cartridge and the second inkjet cartridge respectively have a first plurality of contacts and a second plurality of contacts. The first contacts and the second contacts are arranged into a first identifiable area and a second identifiable area, and the

first identifiable area and the second identifiable area are associated with the colors of ink stored in the first inkjet cartridge and the second inkjet cartridge. The method includes detecting the first identifiable area and the second identifiable area, sending a first signal and a second signal, receiving the first signal and the second signal, and determining whether the first inkjet cartridge and the second inkjet cartridge are correctly placed.

[0013] It is an advantage of the claimed invention that by viewing the identifiable TAB, the user of the inkjet apparatus can easily distinguish between the different types of inkjet cartridges. Moreover, if the user accidentally inserts the inkjet cartridge into the wrong slot in the inkjet apparatus, the inkjet apparatus can alert the user to the misplaced condition.

[0014] These and other objectives of the claimed invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment, which is illustrated in the various figures and drawings.

#### **BRIEF DESCRIPTION OF DRAWINGS**

[0015] Fig.1 is a perspective view of an inkjet apparatus having printhead cartridges installed.

- [0016] Fig.2 is a schematic drawing of a conventional printing module in the inkjet apparatus.
- [0017] Fig.3 is a schematic drawing of a printing module in the inkjet apparatus according to the preferred embodiment of the invention.
- [0018] Fig.4 is a cross-sectional diagram drawn along line 4-4" of Fig.3.
- [0019] Fig.5 is a perspective view of the inkjet cartridge according to the present invention.
- [0020] Fig.6 illustrates a perspective diagram of the inkjet cartridge in which the TAB is not folded.
- [0021] Fig.7 and Fig.8 show examples of creating an identifiable area using contacts of the TAB.
- [0022] Fig.9 is a flowchart representing a method of preventing the misplacement of inkjet cartridges according to the present invention.

#### **DETAILED DESCRIPTION**

- [0023] Please refer to Fig.3. Fig.3 is a schematic drawing of a printing module 200 in the inkjet apparatus 10 according to the preferred embodiment of the invention. The printing module 200 of the present invention is an improvement of the printing module 100 of the prior art. The printing module 200, situated inside the housing of the

inkjet apparatus 10, includes a carriage 202, a rod 204, a print platform 206 and sidewalls 208a and 208b. The sidewalls 208a and 208b are set oppositely, and two ends of the rod 204 are respectively connected to the sidewalls 208a and 208b. The carriage 202, removably mounted on the rod 204, can move forward or backward over the print platform 206 along the direction of arrow 205 during printing operation. The carriage 202 comprises a control unit 225, sensors 220a and 220b, printed circuit boards (PCBs) 210a and 210b, and cartridge-setting slots 212a and 212b for receiving the inkjet cartridges 214a and 214b. Also, there are flexible PCBs 216a and 216b attached at the surfaces 215a and 215b of the inkjet cartridges 214a and 214b, respectively. Alternatively, the PCBs 210a and 210b could be designed as one integrated PCB.

[0024] When the inkjet cartridges 214a and 214b are respectively put into the cartridge-setting slots 212a and 212b, the flexible PCBs 216a and 216b could electrically couple to the PCBs 210a and 210b at the carriage 202. Therefore, current is conducted into the flexible PCBs 216a and 216b through the PCBs 210a and 210b, and the inkjet apparatus 10 controls the movement of the carriage 202 and



drives the inkjet cartridges 214a and 214b to eject ink. If the user misplaces the cartridges 214a and 214b into the wrong slots (212a and 212b), the printing operation is terminated and is not performed.

[0025] In this preferred embodiment, the cartridge 214b is a single-color cartridge filled with black ink, while the cartridge 214a is a color cartridge filled with three different colors of ink such as cyan, magenta and yellow. In the practical application, the color of ink filled in the cartridge could optionally be cyan, magenta, yellow, light black, light cyan, light magenta, or light yellow. In addition, any number of cartridges can be used, and single colors or any combination of multiple colors can be used in each of the cartridges according to the present invention. For instance, four individual cartridges can be used. The four cartridges could contain the colors black, cyan, magenta, and yellow. On the other hand, two cartridges can be used each having multiple colors of ink. An example of this scenario is using a photo cartridge in conjunction with a color cartridge. The photo cartridge could have the colors light cyan, light magenta, and black. The color cartridge could have the colors cyan, magenta, and yellow.

[0026] Each of the flexible PCBs 216a and 216b contains a plu-

rality of contacts (not shown in Fig.3) that respectively make electrical contact with the PCBs 210a and 210b of the carriage 202. As will be described later, the contacts are arranged to form an identifiable area. The identifiable area helps users of the inkjet apparatus 10 easily identify the types of cartridges when inserting cartridges into the inkjet apparatus 10. Therefore, the user immediately knows the type of the cartridges 214a and 214b by looking at the arrangement of the contacts on the flexible PCBs 216a and 216b.

[0027] The sensors 220a and 220b are disposed on the carriage 202 to prevent the misplacement of the cartridges 214a and 214b on the carriage 202. The sensors 220a and 220b are disposed underneath the PCBs 210a and 210b and are electrically connected to the control unit 225. The sensors 220a and 220b sense the pattern of contacts on the flexible PCBs 216a and 216b of the cartridges 214a and 214b. The sensors 220a and 220b may be charged coupling devices (CCDs) or contact image sensors (CISs). The sensors 220a and 220b then send first and second signals to the control unit 225, and the control unit 225 determines the type of cartridges placed in the cartridge-setting slots 212a and 212b of the carriage 202. The sen-

sors 220a and 220b can send the first and second signals to the control unit 225 wirelessly or through wires connecting the sensors 220a and 220b to the control unit 225.

[0028] Please refer to Fig.4. Fig.4 is a cross-sectional diagram drawn along line 4-4" of Fig.3. Each of the sensors 220a and 220b is disposed on the carriage 202. Next, the PCBs 210a and 210b are respectively disposed on the sensors 220a and 220b. The PCBs 210a and 210b are preferably made out of transparent material so that the sensors 220a and 220b can sense the pattern of contacts on the flexible PCBs 216a and 216b.

[0029] Please refer to Fig.5. Fig.5 is a perspective view of the inkjet cartridge 214a according to the present invention. For convenience, the inkjet cartridge 214a is used as an example of all inkjet cartridges used in the present invention, and is also representative of the inkjet cartridge 214b. The inkjet cartridge 214a has an ink reservoir 232 for holding ink of at least one color. Depending on the type of inkjet cartridge 214a being used, there may also be three or more ink reservoirs 232 for holding different colors of ink. The inkjet cartridge 214a also contains a tape automated bonding (TAB) device 230 formed on the

surface 215a of the inkjet cartridge 214a. The TAB 230 contains the flexible PCB 216a, a printhead 238 formed on the flexible PCB 216a, a plurality of contacts 234 formed on the flexible PCB 216a for contacting with the PCB 210a of the carriage 202, and a plurality of conductive traces 236 for connecting each of the contacts 234 to the printhead 238.

[0030] As can be seen in Fig.5, the contacts 234 on the TAB 230 are arranged to form the shape of the letter "P". The contacts 234 are used as an identifiable area of the inkjet cartridge 214a. The contacts 234 in the identifiable area can be arranged into the shape of a trademark, a brand name, or a pattern that indicates the color of ink stored in the inkjet cartridge 214a. For instance, the letter "P" can indicate that the inkjet cartridge 214a is a photo cartridge. As shown in Fig.5, the TAB 230 is disposed on the front surface and the bottom surface of the inkjet cartridge 214a.

[0031] Please refer to Fig.6. Fig.6 illustrates a perspective diagram of the inkjet cartridge 214a in which the TAB 230 is not folded. The lower end of the TAB 230 can be bent inwards along the direction of arrow 250 to attach the lower end of the TAB 230 to the bottom surface of the inkjet

cartridge 214a.

[0032] Please refer to Fig.7 and Fig.8. Fig.7 and Fig.8 show examples of creating an identifiable area using contacts 234 of the TAB 230. Like Fig.6, the TABs 230 shown in Fig.7 and Fig.8 are not folded. The contacts 234 on the TAB 230 shown in Fig.7 are arranged to form the letter "P". Likewise, the contacts 234 on the TAB 230 shown in Fig.8 are arranged to form the letter "B". There are numerous ways to represent the colors of ink used in the inkjet cartridge 214a. The following lists some example codes for indicating the color of ink in the inkjet cartridge 214a: "CI" for a color cartridge, "B" or "Bk" for black, "P" or "Ph" for a photo cartridge. In addition, "C", "M", "Y", "c", and "m" can be used to identify cyan, magenta, yellow, light cyan, and light magenta, respectively. The printhead 238 contains a plurality of nozzles 239 for ejecting the colored ink from the inkjet cartridge 214a.

[0033] Please refer to Fig.9. Fig.9 is a flowchart representing a method of preventing the misplacement of inkjet cartridges according to the present invention. Steps contained in the flowchart will be explained below.

[0034] Step 270:Start;

[0035] Step 272:The sensors 220a and 220b respectively detect

the identifiable areas of the inkjet cartridges 214a and 214b. The sensors 220a and 220b detect the pattern of the contacts 234 and the conductive traces 236 on the TABs 230 of the inkjet cartridges 214a and 214b, and send a first signal and a second signal to the control unit 225;

[0036] Step 274: The control unit 225 receives the first and the second signals from the sensors 220a and 220b, and determines whether the inkjet cartridges 214a and 214b are placed in the correct positions. If the control unit 225 determines that the inkjet cartridges 214a and 214b are placed in the correct positions, the printing operation is allowed to proceed and the process ends in step 278; otherwise, the flow proceeds to step 276;

[0037] Step 276: When the inkjet cartridges 214a and 214b are misplaced at the slots 212b and 212a, the control unit 225 sends a warning signal like a sound or a sign to alert the user. After noticing the warning signal, the user has a chance to switch or change the inkjet cartridges 214a and 214b; and

[0038] Step 278: End.

[0039] In summary, the present invention proposes inkjet cartridges with an identifiable TAB. Users of an inkjet appa-

ratus can easily and quickly distinguish between the different types of inkjet cartridges by looking at the identifiable TABs. The present invention is suited for use in inkjet cartridges used in any inkjet apparatus, such as a copy machine, a facsimile machine, or an inkjet printer. Moreover, even if the user still inserts the inkjet cartridge into the wrong slot in the inkjet apparatus, the inkjet apparatus can produce alert the user to the misplaced condition.

[0040] Those skilled in the art will readily appreciate that numerous modifications and alterations of the device may be made without departing from the scope of the present invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.